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EFFECTS OF SUBJECT- VERSUS EXPERIMENTER-SELECTED REINFORCERS ON THE BEHAVIOR OF INDIVIDUALS WITH PROFOUND DEVELOPMENTAL DISABILITIES

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Results from a number of studies have shown that individuals with profound developmental disabilities often show differential approach behavior to stimuli presented in a variety of formats, and that such behavior is a reasonably good predictor of reinforcement effects when these "preferred" stimuli are used subsequently in a contingent arrangement. Recent data suggest that reinforcement effects may be enhanced further by allowing individuals to select, just prior to training sessions, which (of several) preferred stimuli would be used as reinforcers, but whether this method is superior to one based on selection by a teacher or therapist has not been adequately addressed. We compared the effects of these two methods of reinforcer selection on rates of responding on a free-operant task, using stimuli previously identified as potential reinforcers. Results obtained with 4 subjects indicated little or no difference in reinforcement effects when stimuli were selected by subjects rather than experimenters. Implications of these results with respect to choice and its relation to reinforcement are discussed.

DESCRIPTORS: assessment, choice, reinforcement

The problem of reinforcer selection is central to habilitative efforts with persons who have developmental disabilities. Acquisition and maintenance of adaptive behaviors are direct functions of reinforcement effects; however, reinforcing stimuli for these individuals are often idiosyncratic (Pace, Ivancic, Edwards, Iwata, & Page, 1985) and may not be readily apparent even to teachers and therapists who work with an individual on a daily basis (Green et al., 1988). Thus, an important trend in the provision of services to individuals with severely limited repertoires is the emergence of a technology for identifying reinforcers. Several procedures have been developed to assess preferences among stimuli and to test their reinforcing effects (e.g., Ferrari & Harris, 1981; Fisher et al., 1992; Pace et al., 1985; Wacker, Berg, Wiggins, Muldoon, & Cavanaugh, 1985). Reinforcers selected using such procedures have facilitated acquisition of adaptive skills (e.g., Pace et al., 1985) as well as reductions in the frequency of problem behavior (e.g., Steege, Wacker, Berg, Cigrand, & Cooper, 1989).

The growth of this technology has paralleled (perhaps not coincidentally) an increasing emphasis on the right of disabled individuals to make choices regarding fundamental issues in their lives. Bannerman, Sheldon, Sherman, and Harchik (1990) discussed the issues of client rights and choice making at length and concluded that client preference should play an important role in the initial development of educational plans, and that changes in preference should be accommodated during treatment. Increased concern with the right to choose has not been lost on researchers; several studies have shown positive effects of choice making on behaviors such as participation in activities (e.g., Dattilo & Rusch, 1985), maladaptive responses (e.g., Dunlap et al., 1994; Dyer, Dunlap, & Winterling, 1990), task performance (e.g., Bambara, Ager, & Koger, 1994; Parsons, Reid, Reynolds, & Bumgarner, 1990), and social interaction (Kennedy & Haring, 1993).

In an extension of research on both reinforcer identification and choice, Mason, McGee, Farmer-Dougan, and Risley (1989) examined the effects on task performance of consequences selected by teachers versus those chosen by subjects according

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to a procedure they described as a "reinforcer-assessment package." The package consisted of first administering a successive-choice procedure, similar to that used by Pace et al. (1985), to identify a pool of preferred stimuli. Subsequently, pairs of preferred stimuli were presented to a student in a concurrent-choice arrangement, and the student was asked to "pick one." The chosen stimuli were used as reinforcers in a skill-acquisition session that immediately followed. In another condition, teachers chose prospective reinforcers from the pool of toys and activities normally available in the classroom. The use of stimuli identified via the reinforcer-assessment package resulted in lower rates of maladaptive behavior during training than did the use of teacher-selected stimuli. Although Mason et al. presented a novel approach that simultaneously addressed the collateral issues of reinforcer assessment and choice making, procedural problems limit the strength of their conclusions.

First, the experimental condition was one in which subject-selected reinforcers (via concurrent choice) were drawn from a pool to which subjects had already exhibited high levels of approach behavior (via successive choice), whereas the control condition was one in which reinforcers were drawn arbitrarily from a teacher-generated pool of items. In light of previous research showing that identifying preferred stimuli through successive choice (e.g., Pace et al., 1985) may be a more effective means of selecting reinforcers than relying upon caregiver opinion (Green et al., 1988), it is quite possible that the initial assessment alone was responsible for the superiority of the "package." That is, differential effects could be attributed to the manner in which the initial pool of stimuli was selected (subject preference vs. teacher selection), rather than to subject versus teacher selection immediately prior to a given session. Therefore, the design of the Mason et al. (1989) study did not permit evaluation of the effects of the subject's (concurrent) choices independent of the outcome of a previous assessment (in which the pool of items was formed based on the subject's successive choices). Due to this confounding effect, the authors' conclusion that their results were a function of subjects' choices immediately prior to a session must be viewed with caution.

A second limitation of the Mason et al. (1989) study was the use of reductions in maladaptive behavior as the primary dependent variable, which at best are indirect measures of reinforcement effects during acquisition. Decreases in maladaptive behavior during training are usually associated with increases in appropriate behavior as a function of reinforcement (exceptions to this occur when the inappropriate behavior is extinguished or punished). However, the data on correct responding reported by Mason et al. showed little or no difference between conditions; thus, the process by which decreases in maladaptive behaviors occurred was unexplained and could not be attributed to differential reinforcement effects because there were none. Finally, because experimental conditions were presented in a multiple baseline sequence during training on a skill-acquisition task, in which the condition using teacher-selected reinforcers always preceded the reinforcer-assessment package condition, it is possible that superior effects (either increases in compliance or decreases in maladaptive behavior) obtained in the reinforcer-assessment package condition could be attributable at least in part to sequence effects, such as practice or habituation to the training situation.

Thus, although the results reported by Mason et al. (1989) suggest that presession choice among reinforcers by subjects may enhance performance, additional controls as well as a more direct measure of reinforcement effects are required in order to establish the validity of their findings. In this study, we examined the extent to which presession (concurrent) choice improves on the results of prior assessment (via the successive-choice procedure) by separating the effects of these two procedures. That is, the effects of successive choice were held constant and were used as the basis for determining the pool of stimuli from which all concurrent selections were made, thus permitting the isolation of concurrent choice just prior to sessions as an independent variable. Using this control procedure, two methods of selecting reinforcers from a set of stimuli identified through systematic assessment were compared. In

one condition, stimuli were selected by experimenters; in a second condition, subjects were permitted to select stimuli to be used as reinforcers. The relative effects of reinforcers thus selected on free-operant responding was then compared using a multielement design, which allowed concurrent measurement of performance during both conditions.

METHOD

Subjects, Setting, and Materials

Four individuals living in a public residential facility for persons with developmental disabilities participated. Referrals for the study were made by facility staff, who identified individuals who could benefit from reinforcer assessment and a program to maximize reinforcer efficacy. All subjects were diagnosed with profound mental retardation, and several had secondary disabling conditions. Each subject responded to simple verbal instructions and/or visual prompts. Although some subjects were reported to engage in maladaptive behaviors, these responses did not interfere with the conduct of experimental sessions. Henry was a 33-year-old male with secondary diagnoses of visual impairment and contractures of the right arm. Edward was a 33-year-old male who displayed occasional agitated behavior. Ted was a 34-year-old male with minor aggressive and disruptive behavior. Daphne was a 33-year-old woman with a history of self-injurious behavior.

Sessions for Edward and Daphne were conducted at a day-training program located on the grounds of the residential facility. Henry's and Ted's sessions took place in quiet rooms at their home cottages. The rooms were equipped with a table and two chairs, and all necessary materials were assembled prior to each session. Materials used in Part 1 included a variety of stimuli to be assessed using successive choice, including a mirror, light, taped music, beeping toy, juice, small edible items (Pop Tart® or cracker), vibrator, fan, heating pad, and social praise. Several idiosyncratic stimuli were also assessed for Edward and Daphne. In Part 2, subjects performed a free-operant task. For Henry, Ted, and Daphne, the task was closure of amicroswitch button (Radio Shack foot switch) attached to an Adaptive Aids Control Unit (Model 101). Edward placed small blocks into a plastic bucket. The top of the bucket was covered, and a slot (1 in. by 2 in.) was cut into the cover, through which the blocks were inserted.

Part 1: Successive-Choice Assessment

Subjects were exposed to single-item presentations of a range of potentially reinforcing stimuli using the procedure described by Pace et al. (1985). The initial list included the 10 stimuli described above and two to four additional stimuli for each subject, based on recommendations by residential staff or observed idiosyncratic preferences. Sessions consisted of discrete trials using four stimuli, presented one at a time. Trials were counterbalanced across stimuli, and over several 16-trial sessions, each stimulus was presented 12 times. Approach responses (i.e., reaching for objects, smiling at objects, etc.) were defined for each subject, and the percentage of presentations with an approach response was calculated for each stimulus. Stimuli approached with a minimum criterion of 80% were identified as preferred stimuli. For each subject, four preferred stimuli were selected as the set from which reinforcers were chosen in the comparison conditions.

Part 2: Effects of Experimenter- Versus Subject-Selected Reinforcers

A combined multiple baseline and multielement design was used to evaluate reinforcement effects. Following the collection of baseline data on free-operant responding, comparison conditions in which reinforcers were selected by either the experimenter or the subject were implemented concurrently. Experimenters and subjects selected reinforcers from the same pool of preferred stimuli identified in Part 1. Experimenter- and subject-selection sessions occurred in semirandom order, with neither condition repeated during a given day, and no condition occurred more than twice consecutively. Session length was 10 min.

Baseline. A condition using no reinforcement was conducted to establish (a) an operant rate of responding against which the effectiveness of the two reinforcer-selection procedures would be assessed and (b) behavioral stability due to initial novelty of the conditions and unfamiliarity with the experimental tasks. Target responses were simple free-operant responses (described above). At the beginning of each baseline session, the experimenter directed the subject to emit the target response using verbal or visual prompts. Subjects who did not display these responses in their existing repertoires received a brief training session prior to baseline. There were no consequences for responses emitted during baseline.

Experimenter selection of reinforcers. In this condition, responses produced the presentation of one of the stimuli identified as potentially reinforcing in Part 1. Stimulus presentation followed the first response emitted in a session and, thereafter, was delivered according to a fixed-ratio (FR) 5 schedule of reinforcement. This schedule was selected in order to reduce the likelihood of satiation effects and to generate response rates sufficient to reveal differences in reinforcing efficacy. For each subject, the stimulus to be used in an upcoming session was selected randomly (without replacement within days) during the first several experimenter-selection sessions. That is, the stimuli presented as reinforcers during these sessions were chosen by drawing their printed names from a cup. If, on a given day, a subject-selection session preceded an experimenter-selection session, then the stimulus chosen by the subject was not available for experimenter selection (this precaution avoided potential confounding due to satiation). Thus, four stimuli were available on the first session of a given day; if a second session was conducted, then the three nonselected stimuli were available. Because some subjects displayed consistent preferences among stimuli, this arrangement produced occasional asymmetry between subject and experimenter selections (i.e., some stimuli were often selected by subjects but were seldom selected by experimenters, and vice versa). Therefore, experimenters based their selections in later sessions for Edward and Daphne on previous subject selections in order to restore symmetry (i.e., if social reinforcement had been selected often by subjects but seldom by experimenters, then experimenters selected social reinforcement). This permitted a more direct examination of the effects of the two selection procedures, rather than of the specific stimuli selected.

Subject selection of reinforcers. In this condition, experimenters placed a sample of each available stimulus on the table at which a subject was seated. The relative positions of stimuli were rotated, and each stimulus was the same distance from the subject (approximately 50 cm). For social stimulation, the experimenter's hand was placed among the other choices. Subjects were verbally prompted to choose one stimulus to be used as a reinforcer in the upcoming session. Each subject was observed to reach for one of the stimuli; thus, no special training was necessary to establish the choice response. The first stimulus for which the subject reached was used as the reinforcer in the upcoming session. All other details of this condition were identical to the experimenter-selection condition.

Response Measurement and Reliability

For those subjects whose target response was button pressing, response frequency was automatically recorded by an electronic counter. The overall frequency was then calculated as responses per minute. The electronic counter was tested prior to each session, and no errors in calibration occurred. Responses by Edward, whose target behavior was placing blocks in a bucket, were recorded by counting the number of blocks in the bucket at the end of each session. An assistant then recounted the blocks to insure reliability. If a discrepancy occurred, the blocks were recounted until agreement was achieved. Thus, perfect reliability was obtained for each session.

RESULTS

Successive-Choice Assessment

Results of the successive-choice assessment are shown in Table 1. Henry and Ted approached all

Table 1
Percentage of Trials Scored with Approach Responses

	Henry	Edward	Ted	Daphne
Mirror	95.8	37.5	N/A	100
Light	100[a]	16.6	100[a]	75.0
Music	95.8[a]	16.7	100[a]	100[a]
Beep toy	N/A	N/A	100	N/A
Juice/liquid	83.3	83.3	100	100
Edible item	100	100[a]	100	100[a]
Vibrator	100[a]	58.3	100[a]	91.6
Fan	100[a]	0.0	100[a]	83.3
Social	100	100[a]	100	100[a]
Heat	87.5	58.3	87.5	100
Sound story book	N/A	50.0	N/A	100
Koosh® ball	N/A	75.0	N/A	100[a]
Coffee	N/A	100[a]	N/A	N/A
Pine straw	N/A	100[a]	N/A	N/A

[a] Stimuli used in comparison conditions.

stimuli tested on more than 80% of trials, and light, music, vibrator, and fan were selected as comparison stimuli for both of them. Five preferred stimuli were identified for Edward, and edible items, social praise, coffee (grounds, presented as an olfactory stimulus), and pine straw stimuli were selected as comparison stimuli. Daphne approached 10 of 11 tested stimuli on more than 80% of trials, and music, edible items, social praise, and a Koosh® ball were presented in the comparison conditions.

Experimenter- Versus Subject-Selected Reinforcers

Figure 1 shows session-by-session response rates of each subject during baseline and comparison conditions. A descending trend is apparent in each subject's baseline. Initially higher rates during baseline may have been due to subjects' training histories on similar tasks or instruction-following behavior that was not maintained in the absence of reinforcement. Data from the multielement comparison conditions show a moderate reinforcement effect for each subject; however, no obvious difference between the two choice conditions is seen in these data. Only in Daphne's case does subject selection appear to produce small (albeit inconsistent) increases in response rates over selection by the experimenter.

Figure 2 shows, for each selection procedure, mean percentage increases in response rates over the final five baseline sessions for each stimulus, overall mean percentage increases across all stimuli, and the number of times each stimulus was selected. For Henry, the selection procedure produced no overall differences in responding, with a 402.8% mean increase above baseline for experimenter-selected reinforcers and a 403.7% increase for subject-selected reinforcers. Similarly, selection-procedure effects for individual stimuli were minimal for music, fan, and light; however, subject selection produced the highest levels of responding for vibration. The relative effectiveness of stimuli in maintaining responding showed music to be the most powerful reinforcer (mean percentage increase = 574.1%), followed in order by vibration (mean percentage increase = 453.7%), light (mean percentage increase = 335.2%), and fan (mean percentage increase = 255.6%). The order of preference, based upon the number of times each stimulus was selected by Henry, was fan (four selections), light (three selections), and music and vibration (one selection each). The rank-order correlation between subject preference and performance, based on rankings according to number of subject choices and response rates obtained for each stimulus, was −.89.

Edward's overall mean increases in rates of responding over baseline were 544.2% for experimenter-selected reinforcers and 478.8% for subject-

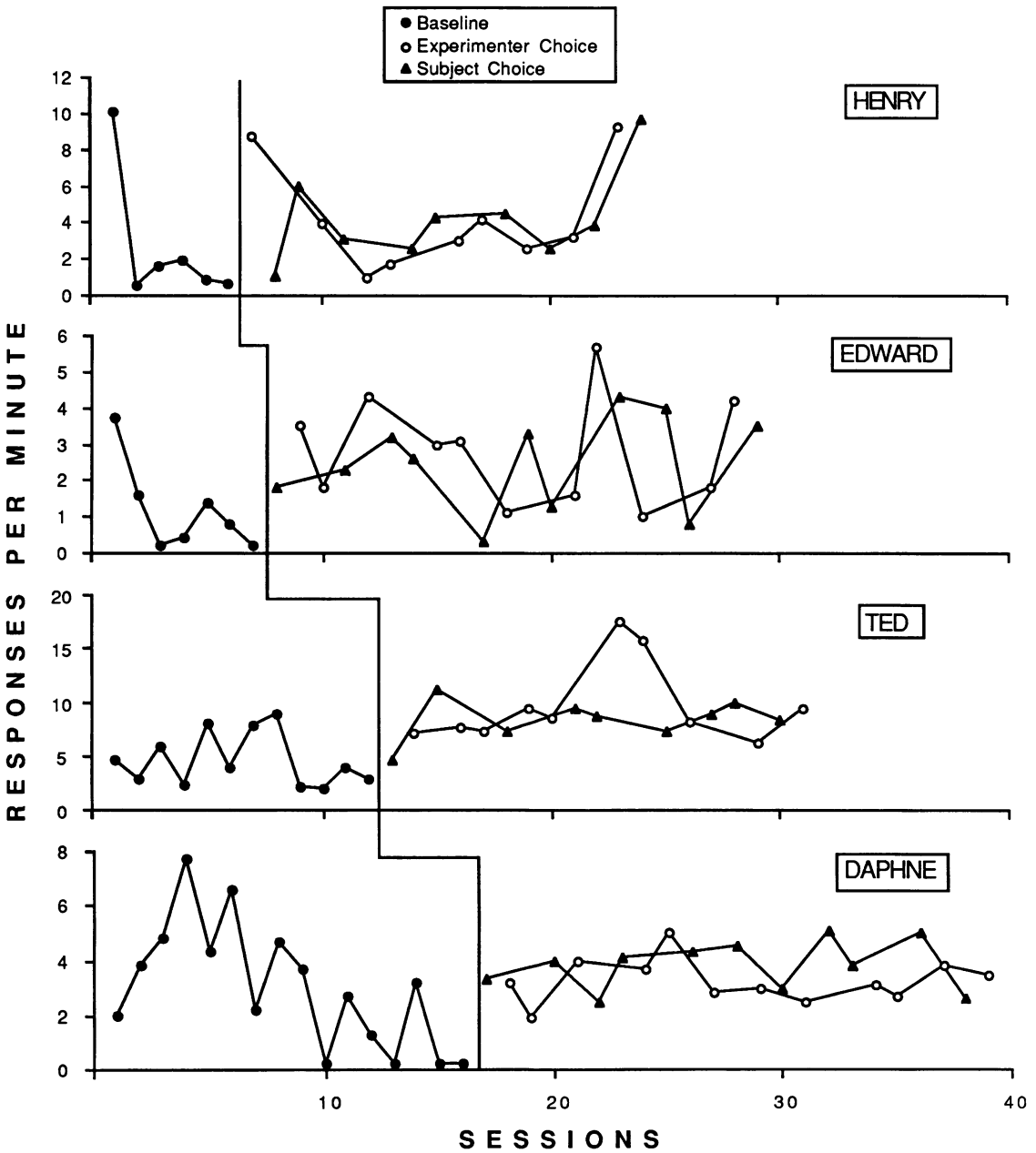

Figure 1. Session-by-session results obtained during baseline and comparison conditions (subject vs. experimenter choice).

selected reinforcers. An examination of selection effects by stimuli showed no difference for edible reinforcers, higher responding when social reinforcers were selected by the experimenter, and higher responding when coffee was selected by the subject. It was not possible to evaluate differences in response rates for pine straw because he never selected it, despite the fact that he was frequently observed to play with pine straw in other contexts. Social reinforcement produced the largest reinforcement effect (mean increase = 713.5% over baseline), followed in order by edible items (mean increase

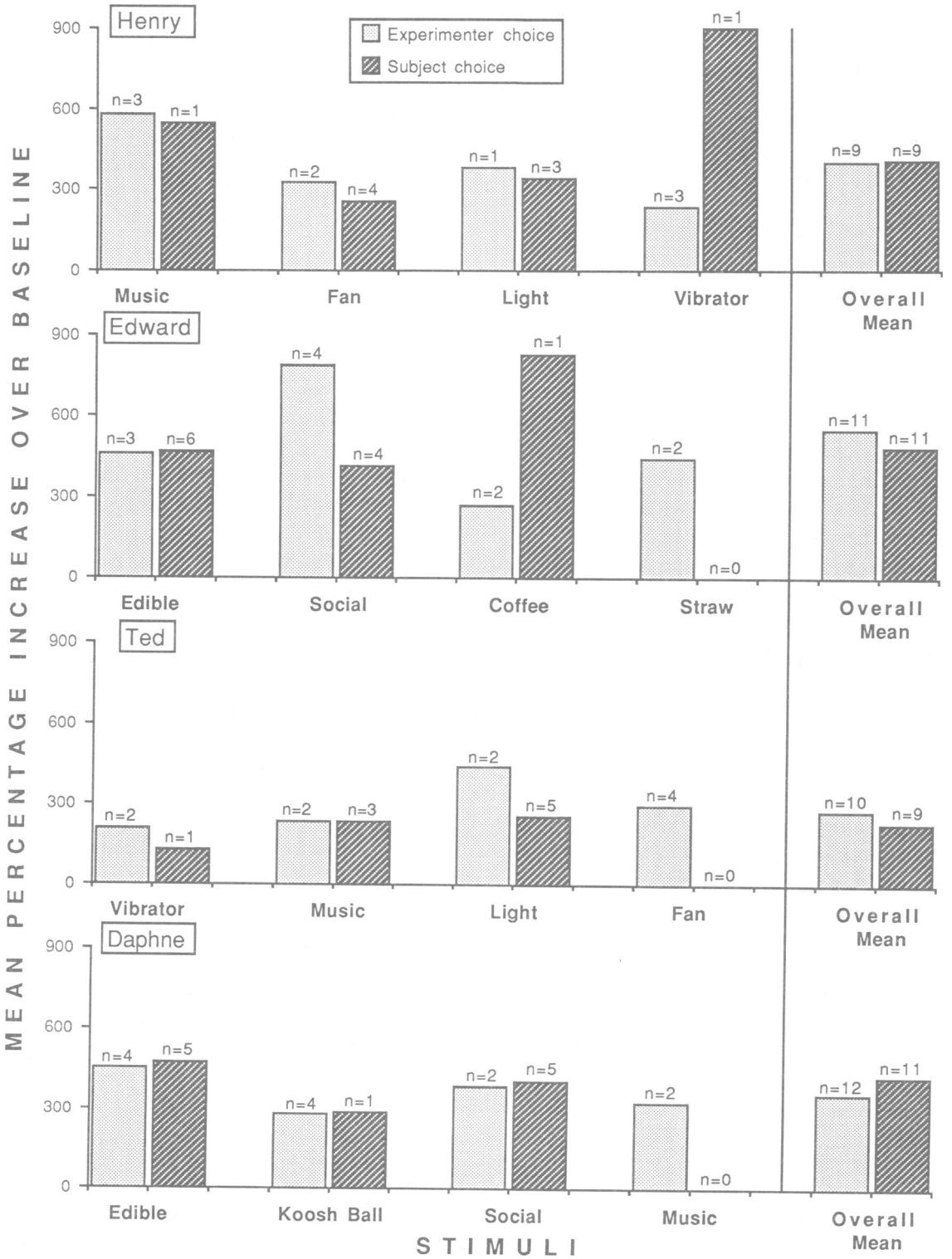

Figure 2. Mean percentage increase over baseline in response rates by stimulus and selection procedure (represented by bars), and number of selections by experimenters and subjects (numbers above bars).

= 463.5%), coffee (mean increase = 455.8%), and pine straw (mean increase = 442.3%). The order of subject preference was edible items (six selections), social praise (four selections), coffee (one selection), and pine straw (no selections). The rank-order correlation between preference and performance was .80.

Ted's overall increases in response rates were slightly higher when the experimenter selected reinforcers (mean increase = 275%) than when the subject selected them (mean increase = 229.2%). Selection effects by stimuli were seen for vibration and light, with higher response rates produced in the experimenter-selection condition. No differences in responding were observed for music, and it was not possible to evaluate the effects of selection procedure for fan because he never selected it. Light produced the highest response rates overall (mean percentage increase = 313.1%), followed by fan (mean increase = 294.4%), music (mean increase = 230.6%), and vibrator (mean increase = 179.4%). The order of subject preference was light (five selections), followed by music (three selections), vibration (one selection), and fan (no selections). The rank-order correlation between preference and performance was .40.

Overall, Daphne's selection of reinforcers produced slightly greater increases in rates of responding (mean increase = 425.6%) when compared with experimenter selection (mean increase = 362.2%). This difference was reflected in her performance with edible items and social reinforcement. No differences were observed between the two selection procedures for Koosh® ball, and it was not possible to assess differences for music because she never selected it. Edible items were the most effective reinforcers, producing a mean response rate increase of 462.2%, followed by social praise (mean increase = 401.1%), music (mean increase = 327.8%), and Koosh® ball (mean increase = 282.2%). Edible items and social reinforcers were selected most frequently by Daphne (five selections each), followed by Koosh® ball (one selection) and music (no selections). The rank-order correlation between preference and performance was .74.

DISCUSSION

Overall results of this study replicate findings of previous research indicating that a successive-choice assessment procedure may be useful in identifying reinforcers for individuals with profound developmental disabilities (e.g., Pace et al., 1985; Wacker et al., 1985). Although each of the subjects in this study had been identified as having few effective reinforcers, all showed increases in responding over a no-reinforcement baseline when a stimulus selected through successive-choice assessment was delivered contingent upon performance.

In general, subject selection of reinforcing stimuli just prior to an experimental session did not produce improved performance over selection of reinforcers by experimenters. That is, given that the pool of reinforcers was comprised of stimuli that had previously occasioned approach responses, the method of reinforcer selection for a given session had little or no effect. Henry's overall mean response rates were virtually equal across selection procedures (mean percentage difference = 0.2%). For Edward and Ted, experimenter-selected reinforcers produced slightly higher rates of responding than did subject-selected reinforcers (mean percentage differences = 12.0% and 16.7%, respectively). Only in Daphne's case did subject selection produce a small increase in mean response rates over experimenter selection (mean percentage difference = 14.9%). All differences in overall response rates were negligible.

Similarly, examination of within-stimulus effects for subject- versus experimenter-selected reinforcers showed few noticeable differences. Experimenter selection produced higher response rates when social reinforcement was chosen for Edward and when light was chosen for Ted. Large subject-selection effects were seen when vibration was chosen by Henry and when coffee was selected by Edward. However, in each case in which large subject-selection effects were obtained, the subject-selection data reflect the outcomes of only one trial; that is, Henry and Edward chose vibration and coffee, respectively, on only one occasion each. Thus, the reliability of the augmentative effect of subject selection in these cases is highly tentative.

Examination of the degree of correspondence between preference (defined by the relative number of subject selections per stimulus) and reinforcer effectiveness (defined by overall response rates per stimulus) revealed that, when provided the opportunity for concurrent choice prior to sessions, these subjects did not reliably select the most generally effective reinforcers. That is, the rank orders of stimuli based on subject preference were typically discordant with the rank orders of overall reinforcer effectiveness, as revealed by low rank-order correlation scores. The mean rank-order correlation across subjects was .261, indicating that subject choices generally were not good predictors of the effectiveness of reinforcers.

Thus, results of the present comparative analysis suggest that, although a successive-choice assessment may identify potential reinforcers, subsequently permitting subjects to choose from among those reinforcers did not appreciably improve task performance. It is notable that data from the successive-choice procedure showed uniformly high rates of approach by 3 of the subjects (Henry, Ted, and Daphne). These results are similar to those obtained by Fisher et al. (1992), who suggested that such assessments too often identify stimuli as highly preferred due to the absence of alternatives. However, results of the present study as well as others (e.g., Green et al., 1988; Pace et al., 1985) showed that stimuli selected based upon the outcomes of successive-choice assessment produced reinforcement effects, regardless of the method of presession stimulus selection. Further, although the Fisher et al. results showed that forced choice produced greater differentiation among chosen alternatives, the low rank-order correlation scores between preference and performance in the current study suggest that differential preference among alternatives does not always reflect differential reinforcing efficacy. There are several possible explanations for these outcomes.

First, the current results must be viewed with some caution due to methodological limitations. The comparisons between subject-selected and experimenter-selected reinforcers were based upon a circumscribed number of sessions (range, 8 to 11). Also, because the number of experimenter selections per stimulus was not directly yoked to the number of subject selections, stimulus-specific effects may confound the overall response rates across selection procedures. That is, if a very powerful reinforcer was seldom selected by a subject but was often selected by the experimenter, then response rates for experimenter-selected reinforcers, averaged across all stimuli, may be artificially inflated (showing effects of particular stimuli but not of the selection procedure per se). However, an examination of response rates, both within and across stimuli, showed a relative absence of large differences, even when large discrepancies existed between the number of experimenter-selection trials and subject-selection trials. Thus, differential effects due to an unequal number of choices are unlikely.

A second possible explanation for the current results is that the selection procedure may not be sufficiently reliable or sensitive to predict reinforcer effectiveness. That is, it is possible that another method for generating presession choices by subjects could produce higher rank-order correlations between selections and reinforcing outcomes. For example, Fisher et al. (1992) used the percentage of time allotted among concurrent alternatives to infer relative reinforcer strength. The effectiveness of this procedure, as well as others, should be examined.

A third explanation of the failure to show selection-procedure effects is that all reinforcers used in the comparison conditions may have been approximately equal in effectiveness. Results of previous research with normal schoolchildren suggest that, when "reward pools" are thus generated, choice may be relatively unimportant (Baer, Tishelman, Degler, Osnes, & Stokes, 1992). This explanation is consistent with the discrepancy between our results and those reported by Mason et al. (1989). A systematic examination of preference and performance among "equally approached" versus "unequally approached" stimuli (e.g., by including seldom-approached stimuli as well as often-approached stimuli in the pool of alternatives from which subjects and experimenters selected) would clarify this issue.

Finally, it may be the case that individuals with

profound developmental disabilities have inadequate histories with respect to making meaningful choices. Often in institutional settings, relations between current behavior and future consequences are tenuous at best. The infrequent and largely noncontingent nature of reinforcement in these settings may not promote the establishment of adaptive choice repertoires. Choice making in the current context involved the selection of stimuli to be presented contingent upon future behavior; it may be that subject choice in the current study reflected only direct and immediate reinforcement for the choice-making response itself, rather than for behavior to be emitted at a later time. Unless clear choices are offered on a consistent basis, and unless a consistent relation is established among choice-making behavior, task performance, and the contingencies for both, then it is unlikely that a meaningful choice repertoire will develop.

Although this study did not demonstrate beneficial effects of permitting individuals with developmental disabilities to choose their reinforcers from among alternatives, it may provide a general framework for teaching the relation between choice and its future consequences. Perhaps frequent opportunities to choose reinforcers, followed by structured sessions in which the chosen reinforcers are presented contingent upon responding (as occurred in this study), would eventually establish adaptive choice-making repertoires. Continued research will be necessary to clarify the results obtained here, and to determine their significance for the training of choice making. Systematic examination of the effects of variables such as the number and nature of choice alternatives, population differences in choice-making competence, and so forth, and further refinement of assessment methods may help to elucidate the necessary conditions for establishing meaningful choice-making repertoires in people with profound developmental disabilities.

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